1

DESCRIPTION

NAVIGATION APPARATUS, ROUTE SEARCHING METHOD, ROUTE

SEARCHING PROGRAM, AND COMPUTER-READABLE RECORDING MEDIUM

5

TECHNICAL FIELD

[0001]

The present invention relates to a navigation

apparatus, a route searching method, a route searching

10 program, and a computer-readable recording medium.

BACKGROUND ART

[0002]

Conventionally, for a car navigation apparatus, route

search in which a route from a starting point to a

15 destination is set to guide a driver following the route is

known as a basic function (see, for example, Patent

Document 1 and Patent Document 2). Especially, in the

technique disclosed in Patent Document 1, a map of an area

near an interchange (IC) to be used on the searched route

20 can be displayed, and an IC to be used can be selected

based on conditions set by an operator.

[0003]

Patent Document 1: Japanese Patent Laid-Open

Publication No. 2002-310709

25 Patent Document 2: Japanese Patent Laid-Open

Publication No. 2000-88593

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0004]

However, in the above conventional techniques

5   disclosed in, for example, Patent Document 1, the operator

has to execute some operation such as setting some

conditions or specifying the IC to be used.

[0005]

Moreover, in the technique disclosed in Patent

10   Document 2, a user has to execute an operation to select

the IC the user desires to use from a list of ICs. If the

user does not execute the operation of selecting, a

different route from the route including the IC that the

user desires to use can be searched. In such a case, even

15   when the user is heading a car for the IC that the user

desires to use not on the route to be guided by the car

navigation apparatus, the car navigation apparatus searches

a route that leads back to an IC that is set by the

apparatus.

20   [0006]

In addition, in the technique in Patent Document 2,

even if the user heads for another IC different from the IC

that the user has specified, without canceling the

specified IC because the user changes his/her mind for the

25   IC to use after the user has specified one IC from the list,

the apparatus repeats search for a route that leads back to

the IC the user has specified.

DISCLOSURE OF INVENTION

MEANS FOR SOLVING PROBLEM

[0007]

5   A navigation apparatus according to the invention of

claim 1 includes a deviation judging unit that judges

whether a moving object has deviated from a guided route to

a destination; a distance calculating unit that calculates

the distance from a deviated point to a planned route point

10   when the moving object has been judged by the deviation

judging unit to have deviated from the guided route before

the moving object transits the planned route point present

on the guided route; a route judging unit that judge

whether the planned route point is transited based on a

15   distance history calculated by the distance calculating

unit; and a re-searching unit that re-searches a guided

route based on the result of the judgment by the transit

judging unit.

[0008]

20   Moreover, a route searching method according to the

invention of claim 8 includes a deviation judging step of

judging whether a moving object has deviated from a guided

route to a destination; a distance calculating step of

calculating the distance from a deviated point to a planned

25   route point when the moving object has been judged at the

deviation judging step to have deviated from the guided

route before the moving object transits the planned route point present on the guided route; a transit judging step of judging whether the planned route point is transited based on a distance history calculated at the distance calculating step; and a re-searching step of re-searching a guided route based on the result of the judgment at the transit judging step.

[0009]

Furthermore, a route searching program according to the invention of claim 9 causes a computer to execute the route searching method according to claim 8.

[0010]

Moreover, a computer-readable recording medium records the route searching program according to claim 9.

BRIEF DESCRIPTION OF DRAWINGS

[0011]

[Fig. 1]   Fig. 1 is a block diagram showing an example of a functional configuration of a navigation apparatus according to an embodiment of the present invention;

[Fig. 2]   Fig. 2 is a flowchart showing an example of a procedure of processes in a route searching method according to the embodiment of the present invention;

[Fig. 3]   Fig. 3 is a block diagram showing an example of a hardware configuration of the navigation apparatus according to an example of the present invention;

[Fig. 4]   Fig. 4 is a flowchart (Part 1) showing a

procedure of processes by the navigation apparatus

according to the example of the present invention;

[Fig. 5] Fig. 5 is a flowchart (Part 2) showing a

procedure of the processes by the navigation apparatus

5 according to the example of the present invention;

[Fig. 6] Fig. 6 is an explanatory view showing an

example of a display screen of the navigation apparatus

according to the example of the present invention;

[Fig. 7] Fig. 7 is an explanatory view showing

10 another example of the display screen of the navigation

apparatus according to the example of the present

invention;

[Fig. 8] Fig. 8 is an explanatory view showing

another example of the display screen of the navigation

15 apparatus according to the example of the present

invention;

[Fig. 9] Fig. 9 is an explanatory view showing

another example of the display screen of the navigation

apparatus according to the example of the present

20 invention;

[Fig. 10] Fig. 10 is an explanatory view showing a

schematic of routes in the example of the present

invention; and

[Fig. 11] Fig. 11 is an explanatory view showing a

25 relation of deviated points with points on scheduled route

in the example of the present invention.

EXPLANATIONS OF LETTERS OR NUMERALS

[0012]

101 Deviation judging unit

102 Distance calculating unit

103 Route judging unit

104 Re-searching unit

105 Presenting unit

106 Acquiring unit

300 Navigation control unit

301 User operation unit

302 Display unit

303 Location recognizing unit

304 Recording medium

305 Recording-medium decoding unit

306 Guiding-sound output unit

307 Point searching unit

308 Route searching unit

309 Route leading unit

310 Guiding-sound creating unit

311 Speaker

600 Display screen

601, 701, 801, 901 Pop-up screen

BEST MODE(S) FOR CARRYING OUT THE INVENTION

[0013]

        Exemplary embodiments of a navigation apparatus, a
route searching method, a route searching program, and a

computer-readable recording medium will be explained in detail below with reference to the accompanying drawings.

[0014]

(Functional Configuration of Navigation Apparatus)

5   A navigation apparatus according to an embodiment of the present invention will be explained first. Fig. 1 is a block diagram showing an example of a functional configuration of the navigation apparatus according to the embodiment of the present invention.

10   [0015]

As shown in Fig. 1, the navigation apparatus installed in a vehicle (including a four-wheel car and a two-wheel car) is configured to include a deviation judging unit 101, a distance calculating unit 102, a route judging unit 103,

15   a re-searching unit 104, a presenting unit 105, and an acquiring unit 106.

[0016]

The deviation judging unit 101 judges whether a moving object has deviated from a guided route to the destination.

20   Specifically, the deviation judging unit 101 judges whether the moving object is present on the route based on, for example, location information of the moving object and route information indicating the guided route. The moving object includes both of the vehicle in which the navigation

25   apparatus is installed and a user carrying the navigation apparatus (for example, a mobile phone).

[0017]

The distance calculating unit 102 calculates a distance from a deviated point to a planned route point when the deviation judging unit 101 judges that the moving object has deviated from the guided route before passing through the planned route point present on the guided route. A "deviated point" may be either a location on the route just before the moving object has started to deviate, or a location of the moving object at the time when it is judged that the moving object has deviated. Because the deviation is detected when the moving object is located at a point deviated from the route, a point at which deviation is detected and the point at which the deviation starts on the route are different. Because either of the points may be used when a linear distance is calculated, the point on the route just before the moving object has started to deviate is used when the distance on the route is to be calculated.

[0018]

The distance from the deviated point to the planned route point may be, for example, a linear distance from the deviated point to the planned route point, a distance along the guided route from the deviated point to the point to be routed, or both of the linear distance and the distance on the route. In the flowchart described later, a route is determined by calculating both of the linear distance and the distance along the route to determined whether the

based on a result of judgment by the route judging unit 103.

[0022]

When the route judging unit 103 has judged that a
planned route point is not to be passed, the presenting
5   unit 105 presents accordingly. This presentation informs a
user of this by, for example, displaying on a display
screen or outputting as sound.

[0023]

The presenting unit 105 may present confirmation of
10   whether to pass the planned route point when the route
judging unit 103 has judged that the planned route point is
not to be passed. The acquiring unit 106 acquires
instruction information in response to the confirmation
presented by the presenting unit 105. At this time, the
15   re-searching unit 104 re-searches a guiding route based on
the instruction information acquired by the acquiring unit
106. Thus, whether the planned route point is to be passed
is confirmed by the user and the re-searching unit 104 can
re-search a route according to the instruction.

20   [0024]

In the case where a first planned route point to be
guided first and a second planned route point to be guided
following the first planned route point are present on a
guided route, the distance calculating unit 102 calculates
25   a first distance that is a distance from the deviated point
to the first planned route point, and a second distance

that is a linear distance from the deviated point to the second planned route point, when the deviation judging unit 101 has judged that the moving object has deviated from the guided route before the moving object passes through the first planned route point. Then, the route judging unit 103 may judge whether the first planned route point is to be passed, based on a history of the first distance and a history of the second distance calculated by the distance calculating unit 102. In this case, although the first distance may be either the distance along the route or the linear distance, the second distance must be only the linear distance.

[0025]

When the first distance is the increasing trend and the second distance is the decreasing trend, the route judging unit 103 judges that the first planned route point is not to be passed. The re-searching unit 104 may re-search a guiding route that does not pass the first planned route point and passes the second planned route point. In this manner, a route is re-searched determining that the moving object is heading for the second planned route point, based on a fact that the moving object is getting away from the first planned route point and is approaching to the second planned route point.

[0026]

Moreover, when a plurality of planned route points are

present, the distance calculating unit 102 may be configured to calculate the distance from a deviated point to a planned route point to be guided first. Furthermore, the re-searching unit 104 may be configured to re-search a guiding route that passes a planned route point to be guided next, when the route judging unit 103 has judged that the planned route point to be guided first is not to be passed.

[0027]

(Procedure of Processes in Route Searching Method)

Procedure of processes in a route searching method according to the embodiment of the present invention will be explained next. Fig. 2 is a flowchart showing an example of the procedure of the processes in the route searching method according to the embodiment of the present invention.

[0028]

As shown in the flowchart of Fig. 2, whether a moving object has arrived at the destination is determined (step S201). When the moving object has not arrived at the destination (step S201: NO), whether the moving object has deviated from a guided route to the destination is determined (step S202). When the moving object has not deviated from the guided route (step S202: NO), the procedure returns to step S201.

[0029]

On the other hand, when the moving object is determined to have deviated from the guided route at step S202 (step S202: YES), whether the moving object has deviated from the guided route before passing through a

5 planned route point that is present on the guided route is determined (step S203). When the moving object has deviated from the guided route after passing through the planned route point (step S203: NO), the procedure proceeds to step S206. When the moving object has deviated from the

10 guided route before passing through the planned route point (step S203: YES), the distance from the deviated point to the planned route point is calculated (step S204).
[0030]

Then, whether the planned route point is to be passed

15 is determined based on the history of distance calculated at step S204 (step S205), and the procedure proceeds to step S206. A guided route is re-searched at step S206 based on a result of judgment at step S205, and the procedure returns to step S201. When the moving object is

20 determined to have arrived at the destination at step S201 (step S201: YES), the series of processes are ended.
EXAMPLE
[0031]
(Hardware Configuration)

25 A hardware configuration of the navigation apparatus according to an example of the present invention will be

explained next. Fig. 3 is a block diagram showing an

example of the hardware configuration of the navigation

apparatus according to the example of the present invention.

[0032]

5   AS shown in Fig. 3, the navigation apparatus is

configured to include a navigation control unit 300, a user

operation unit 301, a display unit 302, a location

recognizing unit 303, a recording medium 304, a recording-

medium decoding unit 305, a guiding-sound output unit 306,

10   a point searching unit 307, a route searching unit 308, a

route leading unit 309, a guiding-sound creating unit 310,

and a speaker 311.

[0033]

The navigation control unit 300 controls the entire

15   navigation apparatus. The user operation unit 301 includes

operation buttons, a remote controller, a touch panel, etc.

The display unit 302 includes a liquid crystal display, an

organic EL display, etc.

[0034]

20   The location recognizing unit 303 acquires location

information of a vehicle that carries the navigation

apparatus. The location information of the vehicle is

information for obtaining a geometric location against a

GPS satellite by receiving a radio wave from the GPS

25   satellite, and the location can be measured anywhere on the

earth. The measurement is executed using an L1 radio wave

being a carrier at 1.575.42 MHz including a C/A (Coarse

and Access) code and a navigation message as the radio wave.

Thus, the current location (the latitude and the longitude)

of the vehicle is detected. Furthermore, information

5   collected by various sensors such as a car speed sensor, a

gyro sensor, etc., may be added.

[0035]

The recording medium 304 is, for example, a hard disk

(HD). Instead of the HD, or, in addition to the HD, a

10   removable recording medium such as a DVD, a compact disc

(CD), etc may be used. The recording-medium decoding unit

305 controls reading/writing from/to the HD, the DVD, or

the CD.

[0036]

15   The navigation control unit 300 outputs, to the

display unit 302, where on a map the moving object is

running, based on the location information of the vehicle

calculated by the location recognizing unit 303 and map DB

information obtained from the recording medium 304 through

20   the recording-medium decoding unit 305.

[0037]

The guiding-sound output unit 306 reproduces guiding

sound by controlling an output to one or more speakers 311

connected.

25   [0038]

The point searching unit 307 searches an arbitrary

point based on information input from the user operation
unit 301, and outputs the point to the display unit 302.
The route searching unit 308 calculates the optimal route
to the retrieved point based on information on the point

5   obtained by the point searching unit 307.   The route
leading unit 309 creates real-time route leading
information based on the information obtained by the route
searching unit 308 and the location information of the
moving object.

10   [0039]

The guiding-sound creating unit 310 creates a tone and
sound data corresponding to a pattern.   That is, the
guiding-sound creating unit 310 creates sound guidance
information corresponding to a guiding point based on the

15   route information, and outputs the sound guidance
information to the guiding-sound output unit 306.
[0040]
(Procedure of Processes by Navigation Apparatus)
A procedure of processes by the navigation apparatus

20   according to the example of the present invention will be
explained next.   Fig. 4 and Fig. 5 are flowcharts showing
the procedure of the processes by the navigation apparatus
according to the example of the present invention.
[0041]

25   As shown in the flowchart of Fig. 4, the destination,
planned route points, etc., are set by an instruction of a

user (step S401). Based on that, a route is searched (step S402), and an interchange (IC) judging counter C is set to zero (step S403). Whether any stored A is present is determined (step S404) and, when the stored A is present

5   (step S404: YES), the A is deleted (step S405). When any stored "A" is not present (step S404: NO), nothing is done and the procedure proceeds to step S406.

[0042]

Thereafter, whether the moving object has arrived at

10   the destination is determined (step S406). When the moving object has arrived at the destination (step S406: YES), the series of processes are ended. When the moving object has not arrived at the destination yet (step S406: NO), whether the location of the moving object is deviated from the

15   guided route is determined (step S407). When the moving object has not deviated from the guided route (step S407: NO), the procedure returns to step S406 and steps at steps S406 and S407 are repeated.

[0043]

20   At step S407, when the location of the moving object is determined to be deviated from the guided route (step S407: YES), a distance A along the route and a linear distance B respectively from the location on the route just before the moving object has started to deviate, to an IC

25   that appears first on the route (hereinafter, "N-IC") are obtained (step S408). Then, whether both of the obtained A

and B are equal to or smaller than a predetermined value, for example, 5 km is determined (step S409).

[0044]

When both A and B are determined to be equal to or smaller than the predetermined value at step S409 (step 409: YES), the IC judging counter C is incremented by one (step S410). Then, A is stored in the HD as a value at the time of a state of the IC judging counter C (step S411). The procedure proceeds to step S501 shown in Fig. 5 and ordinary re-search is executed.

[0045]

On the other hand, when either A or B is determined to be larger than the predetermined value at step S409 (step S409: NO), the IC judging counter is set to zero (step S412). Then, whether any stored A is present is determined (step S413), and when a stored A is present (step S413: YES), the A is deleted (step S414), and the procedure proceeds to step S502 shown in Fig. 5. When any stored A is not present (step S413: NO), nothing is done and the procedure proceeds to step S502 shown in Fig. 5.

[0046]

At step S501 in the flowchart shown in Fig. 5, whether a value of the IC judging counter C is two or less is judged (step S501), and when the count is two or less (step S501: YES), the procedure proceeds to step S502. When the value of the IC judging counter C is not two or less, that

is, three (step S501: NO), a value of the IC judging

counter C at judgment at the time before last (A at time C-

2), a value of the IC judging counter C at last judgment (A

at time C-1), and the value of the IC judging counter C

5   judged this time (A at this time C) are compared with each

other, and it is determined whether (A at time C-2)<(A at

time C-1)<(A at time C), that is, whether A is increasing

(step S503).

[0047]

10   At step S503, when the A is determined not to be

increasing (step S503: NO), the procedure proceeds to step

S502 and ordinary re-search is executed. When A is

increasing (step S503: YES), the N-IC is recognized as an

IC that is not desired to use (step S504).

15   [0048]

At step S504, before recognizing the N-IC as an IC

that is not desired to use, for example, a popup screen 601

that may be displayed on a display screen 600 shown in Fig.

6 to confirm whether the user really does not desire to use

20   the N-IC may be displayed. Fig. 6 is an explanatory view

showing an example of a display screen of the navigation

apparatus according to the example of the present invention.

As shown in Fig. 6, the popup screen 601 is displayed on

the display screen 600. On the popup screen 601, in

25   addition to the name of the N-IC (in the example shown in

Fig. 6, "Kawagoe IC"), a YES button 602 and a NO button 603

to input the instruction information of the user to

presentation of confirmation presented on the popup screen

601 are displayed.

[0049]

5   Then, along with presentation of the name of the N-IC,

an intention that this N-IC has been determined to be an IC

that is not desired to use is presented by displaying, or

by announcing with sound (step S505). Fig. 7 is an

explanatory view showing another example of the display

10   screen of the navigation apparatus according to the example

of the present invention. On the display screen 600 shown

in Fig. 7, the intention that the N-IC has been judged to

be an IC that is not desired to use can be displayed along

with the name of the N-IC by displaying a popup screen 701

15   showing "the route is switched to a route not using Kawagoe

IC on Kanetsu Highway". The popup screen 701 shown in Fig.

7 is not necessarily displayed when the popup screen 601

shown in Fig. 6 has been displayed and the intention of the

user (instruction information) has been confirmed.

20   [0050]

Referring back to the flowchart shown in Fig. 5, at

step S506, when an IC that has been specified as an IC to

use (passing point) is the N-IC, the specification is

canceled and the cancellation is displayed or is announced

25   with sound (step S506). Fig. 8 and Fig. 9 are explanatory

views showing another example of the display screen of the

navigation apparatus according to the example of the

present invention. A display indicating that the

specification of the passing point has been canceled can be

displayed by displaying a popup screen 801 showing a

5   message "the passing point 'XX Station' has been canceled"

on the display screen 600 shown in Fig. 8.

[0051]

On the display screen 600 shown in Fig. 9, a message

"cancel the passing point 'XX Station'?", and a "YES"

10   button 902 and a "NO" button 903 to input the instruction

information of the user for presentation of confirmation

are displayed. The specification of the IC to use may be

canceled after confirming the intention of the user

(instruction information) by displaying this popup screen

15   901.

[0052]

In this manner, the specified IC can be canceled by

keeping on running ignoring the specified IC even without

canceling the specification when the user changes his/her

20   mind on the way to the IC and desires to use another IC

that is different from the IC that the user has specified

to use. For example, when the user has first planned to

pick up Mr. A at XX station, and then to go to YY

department store, but the user receives a call from Mr. A

25   telling the user that Mr. A will go directly to YY

department store, and the user no longer have to go to XX

Station, the specification to visit XX station is required
to be canceled manually in a conventional technique.
However, according to the embodiment, just by running the
car toward YY department store, it can be recognized that

5   XX station is avoided and the route can be re-searched
after displaying the display screen shown in Fig. 8 or
after confirming whether to visit XX station with the
display screen shown in Fig. 9.

[0053]

10   Referring back to the flowchart shown in Fig. 5, at
step 507, the cost of a road corresponding to the N-IC is
increased, thereby making the road hard to be taken, and
then, the route is re-searched. Fig. 10 is an explanatory
view showing a schematic of the routes in the example of

15   the present invention. In Fig. 10, 1000 denotes an own
vehicle, and the own vehicle 1000 is currently running on a
regular road 1002 and is passing through an intersection P1.
After the specification of IC-1 is canceled as an IC not
desired to use, the cost of a route 1003 is increased such

20   that the route 1003 that is a ramp to IC-1 is made hard to
be taken. Specifically, for example, the length of the
route 1003 is made equivalent to several tens of kilometers
although the distance of the route 1003 is actually 500 m.

[0054]

25   By doing so, when the route is re-searched as of this
point, without causing the apparatus to re-search a route

from the intersection P1 through the route 1003 to IC-1,

the apparatus can be caused to re-search another route, for

example, from a point of intersection P2 through a route

1004 to a highway 1001 entering from IC-2.

5   [0055]

(Process for Route Including Plural Planned Route Points)

When a guided route includes plural planned route

points, for example, when the guided route includes the

first planned route point to be guided first and the second

10   planned route point to be guided following the first

planned route point, the first distance that is the

distance from the deviated point from the guided route to

the first planned route point, and the second distance that

is the linear distance from the deviated point to the

15   second planned route point are calculated, and whether to

pass the first planned route point is determined based on

the history of the first distance and the history of the

second distance that have been calculated.   In this case,

although the first distance may be either the distance

20   along the route or the linear distance, the second distance

must only be the linear distance to be used for the

determination.

[0056]

Fig. 11 is an explanatory view showing a relation of

25   deviated points with planned route points in the example of

the present invention.   As shown in Fig. 11, if a distance

A1 to the first planned route point is the increasing tend, that is, (A1 at C-2)<(A1 at C-1)<(A1 at C), and a distance A2 to the second planned route point is the decreasing trend, that is, (A2 at C-2)>(A2 at C-1)>(A2 at C), while

5   the deviated point shifts as C-2→C-1→C, the first planned route point is determined not to be passed. A guiding route not passing the first planned route point but passing the second planned route point is re-searched. In this manner, re-search for a route is executed determining that

10   the user is heading for the second planned route point based on a fact that the moving object is getting away from the first planned route point and is approaching to the second planned route point.

[0057]

15   Although A1 may be either the linear distance or the distance along the route, A2 must only be the linear distance. That is because the distance along the route to the second planned route point is a distance from the deviated point to the second planned route point through

20   the first planned route point; therefore, A2 is obtained as (distance along the route A1)+(distance along the route from the first planned route point to the second planned route point) as the distance along the route. Thus, A2 also increases when A1 increases, and it becomes impossible

25   to tell whether the vehicle is heading for the second planned route point.

[0058]

    The above processes will be described using the flowchart shown in Fig. 4 and Fig. 5 as below. First, at step S408 of the flowchart shown in Fig. 4, the distance A1 from the deviated point to the first planned route point and the linear distance A2 from the deviated point to the second planned route point are calculated. At step S411, A1 and A2 are stored in an HD correlating A1 and A2 respectively with values of C.

[0059]

    At step S503 of the flowchart shown in Fig. 5, whether (A1 at C-2)<(A1 at C-1)<(A1 at C) and (A2 at C-2)>(A2 at C-1)>(A2 at C), that is, whether A1 is increasing and A2 is decreasing is determined. When A1 is increasing and A2 is decreasing (step S503: YES), the procedure proceeds to step S504. When A1 is decreasing or A2 is increasing (step S503: NO), the procedure shifts to step S502.

[0060]

    Moreover, when the route includes plural planned route points, the apparatus may be configured to calculate only the distance from the deviated point to the planned route point to be guided first may be calculated without executing the above steps, and when it is determined that the planned route point to be guided first is not to be passed, a guided route passing the planned route point to be guided next is re-searched.

[0061]

    While in the above example, a case of a car navigation apparatus has been described, the present invention is not limited to the car navigation apparatus, and can be applied

5   to, for example, a navigation apparatus for a walker mounted on a portable information processing terminal such as a mobile phone, and a route presenting application on a website, etc.

[0062]

10   As described above, according to the embodiment, the deviation judging unit 101 judges whether the moving object has deviated from the guided route to the destination; the distance calculating unit 102 calculates the distance from the deviated point to the planned route point when the

15   moving object is judged by the deviation judging unit 101 to have deviated from the guided route before passing the planned route point that is present on the guided route; the route judging unit 103 judges whether the planned route point is to be passed based on the history of distance

20   calculated by the distance calculating unit 102; and the re-searching unit 104 re-searches a guiding route based on a result of judgment by the route judging unit 103. Therefore, when the current location is deviated from the guided route, re-search for a route is executed, and when

25   the re-search is executed for a predetermined number of times, distance from each of the locations at which the re-

search is executed to the planned route point is respectively calculated. Based on a result of calculation, it is determined that the user does not desire to pass the point, and it is determined that, for example, the point is

5   not to be passed, when the distance is the increasing tend.

[0063]

Thus, even if an IC to be used on a recommended route searched is different from the IC that the user actually desires to use, the probability that the route becomes a

10   desirable route increases just by running toward the IC that the user desires to use while deviating from the guided route, without selecting an IC from the list. Therefore, the frequency of re-search and the load on the user can be reduced. Even when the user changes his/her

15   mind on the way to the IC and desires to use another IC that is different from the IC that the user has specified to use, the specification can be canceled without performing cancellation operation for the specification, just by running, ignoring the specified IC.

20   [0064]

Moreover, according to the embodiment, because the route judging unit 103 judges that the planned route point is to be passed when the distance from the deviated point to the planned route point is larger than a predetermined

25   value, this is applied only to the case where the distance to the planned route point is getting smaller, and only

when the distance to the planned route point is the
increasing trend although the user has come close to the
point, it can be determined that the point is not desired
to be passed.

5   [0065]

Furthermore, according to this embodiment, when the
planned route point is determined not to be passed by the
route judging unit 103, the presenting unit 105 presents
accordingly. Therefore, a route passing the point is not

10 canceled against the intention of the user.

[0066]

Moreover, according to the embodiment, when the
planned route point is determined not to be passed by the
route judging unit 103, the presenting unit 105 presents

15 the confirmation whether to pass the planned route point;
the acquiring unit 106 acquires the instruction information
in response to the presentation of the confirmation; and
the re-searching unit 104 re-searches a guiding route based
on the instruction information. Therefore, the route point

20 can be properly canceled. Therefore, the user does not
have to operate the navigation apparatus to select an IC,
and it is possible to cause the navigation apparatus to
automatically search a route including properly selected IC
just by heading the vehicle for an IC that the operator

25 desires to use.

[0067]

Furthermore, according to the embodiment, when the moving object is judged, by the deviation judging unit 101, to be deviated from the guided route before transiting the first planned route point to be guided first, the distance

5   calculating unit 102 calculates the first distance that is the distance from the deviated point to the first planned route point and the second distance that is the linear distance from the deviated point to the second planned route point to be guided following the first planned route

10 point; and the route judging unit 103 judges whether the first planned route point is to be passed based on the history of the first distance and the history of the second distance calculated by the distance calculating unit 102. For example, when the first distance is the increasing

15 trend and the second distance is the decreasing trend, the route judging unit 103 judges that the first planned route point is not to be passed and the re-searching unit 104 re-searches a guiding route not passing the first planned route point and passing the second planned route point.

20 Therefore, even when plural planned route points are present, some of those route points can be efficiently canceled.

[0068]

Moreover, according to the embodiment, when plural

25 planned route points are present, the distance calculating unit 102 calculates only the distance from the deviated

point to the planned route point to be guided first, and

when the planned route point to be guided first is judged

by the route judging unit 103 not to be passed, the re-

searching unit 104 may re-search a guiding route passing a

5   planned route point to be guided next.

[0069]

The route searching method in the embodiment may be

realized with a computer-readable program prepared in

advance, that is readable by a computer (for example, a

10   micro-computer) and may be realized by executing the

program on the computer. This program is recorded on a

computer-readable recording medium such as an HD, an FD, a

CD-ROM, an MO, a DVD, etc., and is executed by being read

from the recording medium by the computer. This program

15   may be a transmission medium that can be distributed

through a network such as the Internet.